Scholars Journal of Dental Sciences
Abbreviated Key Title: Sch J Dent Sci
ISSN 2394-4951 (Print) | ISSN 2394-496X (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Prevalence of Occupational Hazards among Dentists (Cross-Sectional Study)

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DOI: https://doi.org/10.36347/sjds.2024.v11i09.005 | **Received:** 11.10.2024 | **Accepted:** 16.11.2024 | **Published:** 18.11.2024

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Abstract **Original Research Article**

Dentistry is widely recognized as a profession with significant occupational hazards. Dental staff are commonly exposed to various risks, including psychological stress, workplace, chemical agents, physical and biological hazards, and ergonomic challenges. This study aims to assess the prevalence of different occupational hazards among dentists. ***Subject & methods:*** A total of 449 pediatricians were randomly selected to participate in an online self-reported cross-sectional survey questionnaire designed to collect personal details and assess their exposure to different occupational hazards. ***Results:*** A significant proportion of participants reported experiencing stress (85.9%), followed by musculoskeletal disorders (85.6%) and percutaneous injuries (63.9%). Exposure to radiation hazards was noted by 51.3%, while 44.4% reported eye injuries, and 42.66% faced chemical hazards. Hearing impairment was the least reported hazard, affecting only 8.8% of the participants. ***Conclusions:*** Musculoskeletal disorders remain a major concern for dental professionals, yet research on their specific challenges is limited. Prioritizing professional education, updating curricula, and implementing ergonomic measures are essential. Future studies should address mental stress, occupational hearing loss, and chemical exposure to enhance workplace safety.

Keywords: Prevalence, occupational hazards, dentistry.

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INTRODUCTION

Studies have indicated that dentists experience more frequent and severe health issues than other high-risk medical professionals [1]. The awareness of occupational hazards dates back to the 18th century when Bernardino Ramazzini [1], known as the "Father of Occupational Medicine," identified the link between occupation and health dynamics [2]. Despite being considered one of the least hazardous professions in modern times, dentistry still faces numerous risks [3]. Dental practitioners are exposed to various occupational hazards, including stress, allergic reactions, high noise levels, percutaneous exposure incidents, radiation, work-related musculoskeletal disorders (WMSDs), and legal challenges. Additionally, the dental environment poses a significant risk of exposure to microorganisms. Infectious agents in blood or saliva, due to bacteremia or viremia, can cause systemic infections. Both dental patients and dental healthcare workers are at risk of exposure to microorganisms through blood, oral, or respiratory secretions. These microbes can enter the body through skin cuts during medical or dental procedures, accidental bites, or needle stick injuries during anesthesia administration [4]. In dentistry, radiographs play a key role in diagnosing and evaluating oral diseases and are essential for effective treatment planning. Radiographic equipment, in dental clinics, is a vital component of dental assessments [5,6]. Commonly Dental professionals are exposed to both ionizing and non-ionizing radiation during practice. The growing use of ultraviolet and blue light to cure or polymerize various dental materials has raised concerns regarding non-ionizing radiation. Prolonged exposure to these wavelengths can harm multiple areas of the eye, including the cornea, lens, and retina [7, 8]. Dental staff frequently work under high-intensity light for extended periods, essential for dental procedures which may lead to visual discomfort and associated physical symptoms, such as headaches, eye pain, and watering. Proper as headaches, eye pain, and watering [9]. Lighting is critical for dental procedures to avoid errors that could negatively impact patients. Visual tasks during procedures often cause eye strain and fatigue, as close

and frequent operations require optimal lighting. Poorly distributed light in dental offices can create contrast issues [10]. The absence of safety protocols in dental clinics can significantly impact operations and lead to accidents. Inadequate workplace design is a leading cause of such incidents [11,12]. In Norway, the prevalence of occupational health problems in public health dentists has been various occupational complaints, including dermatoses 40%, eye, respiratory, and systemic issues 13%, and musculoskeletal problems (3%) [13]. Studies in Australia indicated that burns were common workplace injuries among dental assistants, and percutaneous injuries were relatively frequent among dental students [14]. A previous study in India found that 47% of Navy dentists had sustained injuries from sharp instruments within the past six months, with back aches being the most common issue 70.6%, followed by occasional anxiety and wrist pain [15]. A study designed in Saudi Arabia on hearing issues among dentists and auxiliaries over five years found that 16.6% experienced tinnitus, 30% had speech discrimination difficulties, and 30.8% faced challenges with speech environments [16]. At an Australian dental school, 9% of dental personnel reported latex allergies, and 22% experienced glove-related dermatitis [17]. Research suggests that factors such as posture, work habits, and demographics influence the prevalence and location of pain and other symptoms like headaches [18]. At the University of Cartagena, 80% of dental students reported muscular pain associated with clinical practice, especially in surgery and periodontics. Among these, 15% experienced neck and lumbar pain [19]. In Southern Iran, a study revealed that 33% of dentists reported lower back pain, while 28% experienced dneckpain [20]. In India, Studies conducted that 76-77% of dental staff experienced injuries from sharp tools, 42-43% faced workplace stress, 40% suffered from 3 musculoskeletal and 24% had allergic reactions [21-23]. Another study revealed that over 20% of dentists sustained injuries while working [24]. The results of the study are significant for dental practitioners as they may offer valuable insights into workers' awareness of physical hazards, their safety practices, and the extent of hazards present within the dental department.

MATERIALS AND METHODS

An online, self-reported cross-sectional survey was developed to investigate the prevalence of various occupational hazards among designed questionnaires divided into four sections—demographic data, including age, gender, specialty, and years of work second the dentists.

The survey utilized a predesigned questionnaire divided into four sections. The first section gathered demographic data, including age and gender.

The section featured 10 questions designed to evaluate how physical hazards are managed in dental clinics. The third section included 10 questions aimed at assessing safety and practices among dental staff, such as reporting occupational accidents or health issues, administering first aid, using warning systems, implementing fire suppression measures, and managing healthcare waste.

The fourth section comprised four questions focused on radiation protection measures.

The questionnaire consisted of 30 questions. To ensure its validity and reliability, the questionnaire was reviewed by two experts and validated using confirmatory factor analysis through a structural equation model (SEM).

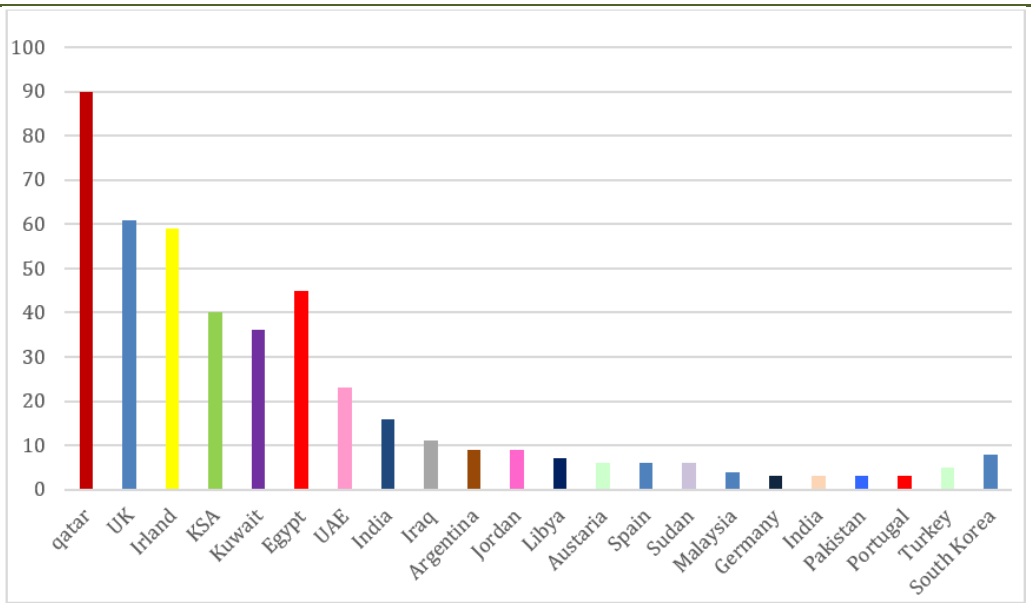
Statistical analysis:

We aimed for a target sample size of at least 383 participants to ensure a confidence level of 95% and a margin of error within ± 5% of the surveyed values[25]. Responses to the survey included duplicate 4 We responses (n=7), and those collected 461 who refused to enroll (n=5) We ended and analyzed by using 449 valid responses. Validated data was Statistical Package for the 7 tabulated, Social Science (SPSS), version 21.0 (SPSS Inc. Chicago, IL, USA). Chi-square $\chi 2$ or Fisher Exact comparative analysis of categorical variables. ($P \leq 0.5$) is considered to be a statistically significant level.

RESULTS

Demographic characteristics: Following the consent to participate in this study, we started exploration of the demographic characteristics of our respondents. A total number of 449 pediatricians responded to the survey from various countries as shown in Figure 1.

Demographic data shows participants belong to different age groups with about 61% (n=274) as males and 39% (n=175) as females. As for the age groups of participants, 5% of them were below 30 years old (n=25), more than half the age was between 30-39 years old (n=238), participants with ages from 40-49 years old were less than one-third of the total (n=133), and those with ages from 50 or above years old were 12% (n= 53) as in Figure 2.



Figer 1: Distribution and numbers of participants according to their country of residence.

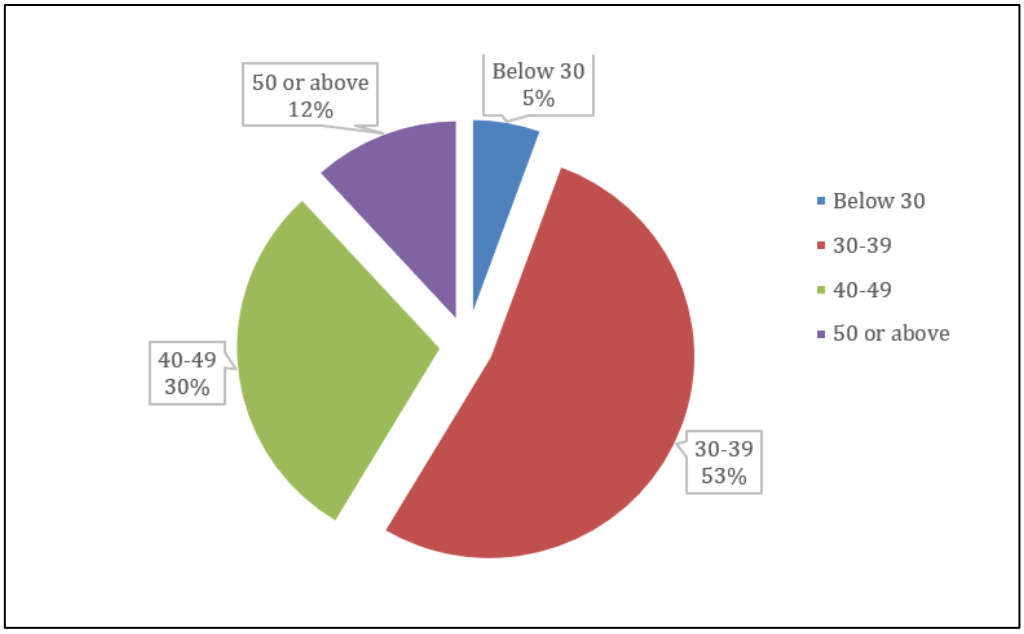


Fig 2: Distribution of age group characteristics of participating

Outlines of the prevalence of various occupational hazards, with psychological hazards being the most frequently reported (Table 1). A significant majority of participants 89.3% perceived dentistry as a stressful profession, and nearly half 51.6% indicated experiencing stress-related symptoms, such as feeling overloaded (Figure 3). Furthermore, 81.9% have at least one sign of WMSDs, with one-third 33% experiencing lower back pain (Figure 4)

Table 1: Prevalence of the different occupational hazards among participants in the study

Type of Hazard	Number of affected dentists	%	Number of non-affected dentists	%
Stress psychological Hazard	401	89.3%	48	10.7%
Percutaneous Injuries	355	79.1%	94	20.9%
Musculoskeletal problem	368	81.9%	81	18.1%
Radiation Hazard	213	47.4%	236	52.6%
Eye Injuries	176	39.2%	273	60.8%
Hearing Impairment	27	6 %	422	94%
Chemical Hazard	259	57.7%	190	42.3%

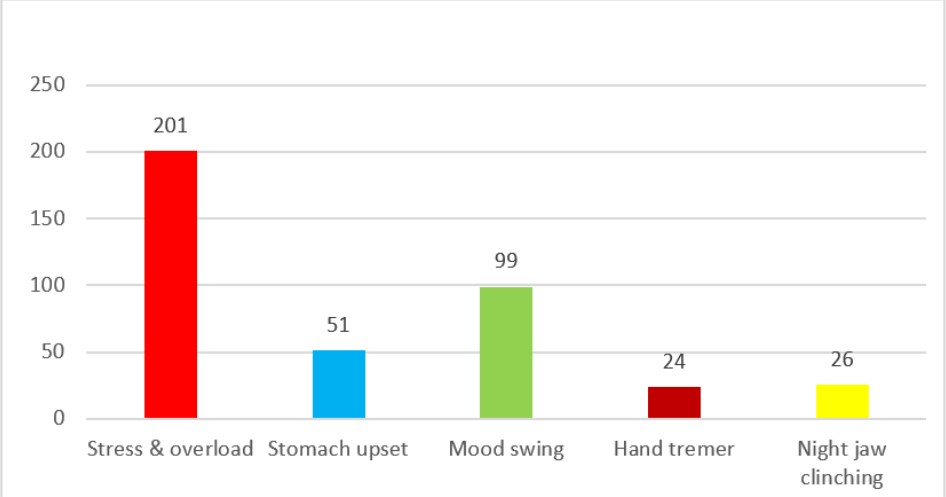


Fig 3: The number of participants have different symptoms of stress

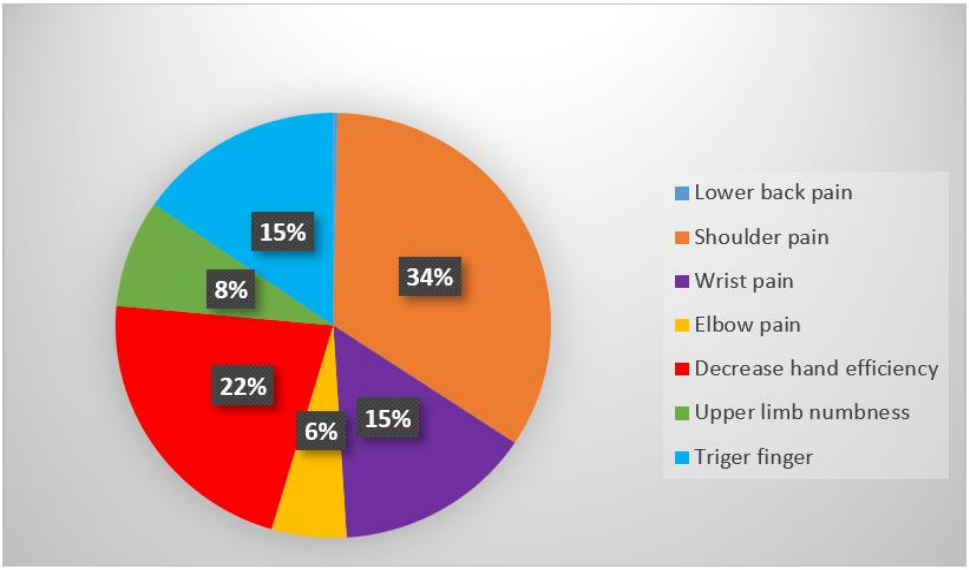


Figure 4: prevalence of musculoskeletal symptoms among disorders among the study's participants

The prevalence of percutaneous injuries was reported at 79.1%, while 47.4% experienced radiological hazards, and 57.9% were affected by chemical hazards, including latex allergy, formaldehyde, x-ray processing solutions, and mercury. Eye injuries were reported by 39.2% of respondents, and hearing impairment was reported by 6%.

Table 2: prevalence of hazards in relation to demographic factors

		psychological Hazard	Percutaneous Injuries	Musculoskeletal	Problem Radiation Hazard	Eye Injuries	Hearing Impairment	Chemical Hazard
Gender	**Male**	25.2%	47%	42.1%	46.9%	48.2%	52%	45.7%
	Female	74.8%	53%	57.9%	53.1%	51.8%	48%	54.3%
Age	**Below 30**	29.4%	45.1%	5%	54.9%	6.3%	11.1%	57.9%
	30-39	15,5%	18.3%	7%	21.5%	8.5%	18.5%	11.2%
	40-49	28.9%	15.5%	70.9%	12.2%	28.4%	22.2%	13.5%
	Above 50	26.2%	21.1%	18.1%	11.4%	56.8%	48.3%	17.4%

A significant relationship was found between percutaneous injuries and age, as shown in (Table 2). Among those suffering from percutaneous injuries, 45.1% were in the age group below 30 years. Chemical hazards were significantly more prevalent among females 54.3% and among dentists below 30 years 57.9%. Radiation hazards were also significantly more common in the age group below 30 years 54.9%. Eye injuries were significantly more prevalent among those above 50 years 56.8%. WMSDs were most common in the 40–49 age group, with a prevalence of 70.9%. Females reported a significantly higher prevalence of injury 57.9%. Hearing impairment was most prevalent among individuals over 50 years, with a prevalence of 48.3%. Psychological hazards were significantly associated with females, with a prevalence of 74.8%

DISCUSSION

Occupational health issues, particularly WMSDs, stress, and percutaneous injuries, are a significant concern among dentists. Despite advancements in dental equipment, studies show a rising trend in these problems. In our study, 81.9% of participants reported at least one symptom of WMSDs which were most prevalent in the 40-4 age group with a prevalence of 70.9%. Females reported a significantly higher rate of injuries 57.9% with lower back pain being the most frequently reported symptom at 30%. Research indicates that most dentists face at least one occupational hazard; for instance, 91% of dentists in Moldova reported exposure to at least one occupational risk [26]. In Nigeria, WMSDs emerged as the most frequently reported occupational health issue among dentists [27]. Biswas *et al.*, reported a high prevalence of musculoskeletal symptoms, particularly affecting the neck, shoulders, hands, wrists, and lower back [28]. Female dentist experienced higher rates of occupational health issues, including WMSDs and percutaneous injuries compared to their male counterparts [29-32]. WMSDs are most frequently reported in the neck, lower back, and shoulders [32]. Female dentists are especially at risk, with higher rates of tendonitis and pain in multiple body regions [33,34]. Notably, awareness of ergonomic practices does not always lead to a reduction in WMSDs prevalence. For instance, a study by (Rafie *et al.,*) [35] revealed that 74% of dentists experienced back and neck pain despite understanding proper posture techniques, and WMSDs prevalence increases with age and clinical experience which especially with prosthodontists being at the greatest risk [36]. The lack of routine job posture and workplace analyses highlights the critical need for comprehensive economic education for both new and experienced dental practitioners [36]. In this study, psychological hazards are the most reported occupational risks among dental practitioners. A large majority 89.3% perceive dentistry as highly stressful with nearly 51.6% experiencing stress-related symptoms. Stress and burn out widespread among dental professionals, driven by factors such as legal and insurance issues, practice management, and staff supervision [37]. Studies from the UK and New Zealand highlight high levels of emotional exhaustion, with stress stemming from treating challenging patients, time pressures, and the need for sustained focus [38,39]. Stress is also a significant contributor to needle-stick injuries [40]. Furthermore, our results showed a notable association was identified between percutaneous injuries and age, with 45.1%of those affected being below 30 years old. Percutaneous injuries are prevalent, with rates of 50% in Southern Thailand and 41.8% in the UAE [26,41]. Younger dentists and students are particularly at risk, highlighting the need for education and supervision [40,42]. Vaccination rates against Hepatitis B and influenza are relatively high among dentists, but percutaneous injuries increase the risk of exposure to infectious diseases such as HIV and Hepatitis C [26]. This study reported that eye injuries were significantly more prevalent among individuals over 50 years of age 56.8%. Ocular hazards remain a concern in dentistry, with insufficient eye protection leading to injuries caused by rotary instruments and chemical exposure [43,44]. Mercury exposure has also been associated with visual impairments, including diminished color discrimination [42]. To reduce these risks, regular eye examinations and the adoption of magnification tools are strongly recommended [44].

Our results indicated that hearing impairment was most common among individuals over 50 years of age, with a prevalence of 48.3%. Noise-induced hearing loss, another significant occupational risk, is linked to noise levels from equipment such as turbines and compressors [45,46]. To safeguard the well-being of both patients and operators, it is crucial to implement measures to reduce noise in dental environments [46].

Our study found that radiation hazards were notably more prevalent in the age group under 30 years, with 54.9% affected. Enhancing dentists' knowledge of radiation protection measures, tools, and dose reduction techniques could promote safe practices in dental radiology [47]. Our findings also indicated that chemical hazards were significantly more common among females 54.3% and individuals under 30 years old 57.9%. Latex allergies are frequently encountered among dentists. In Belgium, 22.5% of dentists reported latex allergies, while 47% of New Zealand residents experienced dermatitis within the past year. However, low-protein, non-powdered gloves can help reduce these risks [39,48].

CONCLUSION

Work health-related concerns of musculoskeletal disorders continue to be among dental professionals. However, there is a notable gap in research addressing the specific challenges dental professionals face. It is imperative to prioritize ongoing professional education, update curricula, implement ergonomic

interventions, and ensure safer materials handling. Future research must endure the mental stress suffered during routine tasks and develop targeted strategies to alleviate these risks. Furthermore, there is a pressing need for more studies on occupational hearing loss and chemical exposure to better protect dental workers.

REFERENCES

1. Brooks, S. L., Rowe, N. H., Drach, J. C., Shipman Jr, C., & Young, S. K. (1981). Prevalence of herpes simplex virus disease in a professional population. *Journal of the American Dental Association (1939)*, *102*(1), 31-34.
2. Fasunloro, A., & Owotade, F. J. (2004). Occupational hazards among clinical dental staff. *J Contemp Dent Pract*, *5*(2), 134-52.
3. Scully, C., Cawson, R.A. & Griffiths, M. (1990). Chapter 1: Mortality and some aspects of morbidity. In: Occupational Hazards to Dental Staff. London,1-21.
4. Hagberg, M., & Wegman, D. H. (1987). Prevalence rates and odds ratios of shoulder-neck diseases in different occupational groups. *Occupational and environmental medicine*, *44*(9), 602-610.
5. Kim, Y. J., Cha, E. S., & Lee, W. J. (2016). Occupational radiation procedures and doses in South Korean dentists. *Community dentistry and oral epidemiology*, *44*(5), 476-484.
6. Little, M. P., Wakeford, R., Tawn, E. J., Bouffler, S. D., & Berrington de Gonzalez, A. (2009). Risks associated with low doses and low dose rates of ionizing radiation: why linearity may be (almost) the best we can do. *Radiology*, *251*(1), 6-12.
7. Zielinski, J. M., Garner, M. J., Krewski, D., Ashmore, J. P., Band, P. R., Fair, M. E., ... & Sont, W. N. (2005). Decreases in occupational exposure to ionizing radiation among Canadian dental workers. *J Can Dent Assoc*, *71*(1), 29-33.
8. Yengopal, V., Naidoo, S., & Chikte, U. M. (2001). Infection control among dentists in private practice in Durban. *SADJ: journal of the South African Dental Association= tydskrif van die Suid-Afrikaanse Tandheelkundige Vereniging*, *56*(12), 580-584.
9. El-Sallamy, R. M., Kabbash, I. A., El-Fatah, S. A., & El-Feky, A. (2018). Physical hazard safety awareness among healthcare workers in Tanta university hospitals, Egypt. *Environmental Science and Pollution Research*, *25*, 30826-30838.
10. Wee, A. G., Meyer, A., Wu, W., & Wichman, C. S. (2016). Lighting conditions used during visual shade matching in private dental offices. *The Journal of prosthetic dentistry*, *115*(4), 469-474.
11. Gambhir, R. S., Singh, G., Sharma, S., Brar, R., & Kakar, H. (2011). Occupational health hazards in the current dental profession-A review. *Mercury*, *81*, 82.
12. Myers, H. L., & Myers, L. B. (2004). 'It's difficult being a dentist': stress and health in the general dental practitioner. *British dental journal*, *197*(2), 89-93.
13. Jacobsen, N., Aasenden, R., & Hensten-Pettersen, A. (1991). Occupational health complaints and adverse patient reactions as perceived by personnel in public dentistry. *Community dentistry and oral epidemiology*, *19*(3), 155-159.
14. McDonald, R. I., Walsh, L. J., & Savage, N. W. (1997). Analysis of workplace injuries in a dental school environment. *Australian dental journal*, *42*(2), 109-113.
15. Chopra, S. S., & Pandey, S. S. (2007). Occupational hazards among dental surgeons. *Medical Journal Armed Forces India*, *63*(1), 23-25.
16. Al Wazzan, K. A., Al Qahtani, M. Q., Al Shethri, S. E., Al Muhaimeed, H. S., & Khan, N. (2005). Hearing problems among the dental personnel. *JPDA*, *14*(4), 210-214.
17. Katelaris, C. H., Widmer, R. P., & Lazarus, R. M. (1996). Prevalence of latex allergy in a dental school. *Medical journal of Australia*, *164*(12), 711-714.
18. Marshall, E. D., Duncombe, L. M., Robinson, R. Q., & Kilbreath, S. L. (1997). Musculoskeletal symptoms in new south wales dentists. *Australian dental journal*, *42*(4), 240-246.
19. Diaz-Caballero, A. J., Gómez-Palencia, I. P., & Díaz-Cárdenas, S. (2010). Ergonomic factors that cause the presence of pain muscle in students of dentistry. *Med Oral Patol Oral Cir Bucal*, *15*(6), e906.
20. Pargali, N., & Joukar, N. (2010). Prevalence of musculoskeletal pain among dentists in Shiraz, Southern Iran.
21. Huaylah, S. H., Al-Qahtani, T. A., & Sandeepa, N. C. (2019). Occupational hazards and preventive practices among dentists in Saudi Arabia: a cross sectional survey. *The Saudi Dental Journal*, *31*, S31-S32.
22. Reddy, V., Bennadi, D., Satish, G., & Kura, U. (2015). Occupational hazards among dentists: A descriptive study. *J Oral Hyg Health*, *3*(185), 2332-0702.
23. Mehta, A., Gupta, M., & Upadhyaya, N. (2013). Status of occupational hazards and their prevention among dental professionals in Chandigarh, India: A comprehensive questionnaire survey. *Dental Research Journal*, *10*(4), 446.
24. Al-Zoughool, M., & Al-Shehri, Z. (2018). Injury and infection in dental clinics: Risk factors and prevention. *Toxicology and industrial health*, *34*(9), 609-619.
25. Select Statistical Services. Population Proportion–Sample Size. [Online] April1st,2020.https://select-statistics.co.uk/calculators/sample-size-calculator-population-proportion/.
26. Bârlean, L., Danila, I., SAVEANU, I., & BALCOS, C. (2013). Occupational health problems among dentists in Moldavian Region of Romania. *The Medical-Surgical Journal*, *117*(3), 784-788.

27. Osazuwa-Peters, N., Azodo, C. C., & Obuekwe, O. N. (2012). Occupational health issues of oral health care workers in Edo State, Nigeria. *International dental journal*, *62*(3), 117-121.
28. Biswas, R., Sachdev, V., Jindal, V., & Ralhan, S. (2012). Musculoskeletal disorders and ergonomic risk factors in dental practice. *Indian Journal of Dental Sciences*, *4*(1).
29. Kurşun, Ş., Evirgen, S., Akbulut, N., Oztas, B., & Vaizoglu, S. A. (2014). Work characteristics and musculoskeletal disorders among postgraduate dental students: A pilot study. *Journal of Musculoskeletal Pain*, *22*(1), 62-67.
30. Kierklo, A., Kobus, A., Jaworska, M., & Botuliński, B. (2011). Work-related muculoskeletal disorders among dentists-a questionnaire survey. *Annals of Agricultural and Environmental Medicine*, *18*(1).
31. Al-Omiri, M. K. (2011). Risk factors and prevalence of musculoskeletal disorders among Jordanian dentists. *Jordan Medical Journal*, *171*(779), 1-20.
32. Ayers, K. M. S., Thomson, W. M., Newton, J. T., Morgaine, K. C., & Rich, A. M. (2009). Self-reported occupational health of general dental practitioners. *Occupational medicine*, *59*(3), 142-148.
33. Alexandre, P. C. B., da Silva, I. C. M., de Souza, L. M. G., de Magalhaes Câmara, V., Palacios, M., & Meyer, A. (2011). Musculoskeletal disorders among Brazilian dentists. *Archives of environmental & occupational health*, *66*(4), 231-235.
34. Harutunian, K., Gargallo Albiol, J., Barbosa de Figueiredo, R. P., & Gay Escoda, C. (2011). Ergonomics and musculoskeletal pain among postgraduate students and faculty members of the School of Dentistry of the University of Barcelona (Spain). A cross-sectional study. *Medicina Oral, Patología Oral y Cirugia Bucal, 2011, vol. 16, num. 3, p. 425-429.*
35. Rafie, F., Zamani Jam, A., Shahravan, A., Raoof, M., & Eskandarizadeh, A. (2015). Prevalence of upper extremity musculoskeletal disorders in dentists: symptoms and risk factors. *Journal of environmental and public health*, *2015*(1), 517346.
36. Rafeemanesh, E., Jafari, Z., Kashani, F. O., & Rahimpour, F. (2013). A study on job postures and musculoskeletal illnesses in dentists. *International journal of occupational medicine and environmental health*, *26*, 615-620.
37. Gorter, R. C., Storm, M. K., Te Brake, J. H. M., Kersten, H. W., & Eijkman, M. A. J. (2007). Outcome of career expectancies and early professional burnout among newly qualified dentists. *International dental journal*, *57*(4), 279-285.
38. Denton, D. A., Newton, J. T., & Bower, E. J. (2008). Occupational burnout and work engagement: a national survey of dentists in the United Kingdom. *British dental journal*, *205*(7), E13-E13.
39. Ayers, K. M. S., Thomson, W. M., Newton, J. T., & Rich, A. M. (2008). Job stressors of New Zealand dentists and their coping strategies. *Occupational medicine*, *58*(4), 275-281.
40. Wicker, S., & Rabenau, H. F. (2010). Occupational exposures to bloodborne viruses among German dental professionals and students in a clinical setting. *International archives of occupational and environmental health*, *83*, 77-83.
41. Chowanadisai, S., Kukiattrakoon, B., Yapong, B., Kedjarune, U., & Leggat, P. A. (2000). Occupational health problems of dentists in southern Thailand. *International dental journal*, *50*(1), 36-40.
42. Canto-Pereira, L. H., Lago, M., Costa, M. F., Rodrigues, A. R., Saito, C. A., Silveira, L. C. L., & Ventura, D. F. (2005). Visual impairment on dentists related to occupational mercury exposure. *Environmental toxicology and pharmacology*, *19*(3), 517-522.
43. Lönnroth, E. C., & Shahnavaz, H. (2001). Users' demands regarding dental safety glasses. Combining a quantitative approach and grounded theory for the data analysis. *International journal of occupational safety and ergonomics*, *7*(1), 49-59.
44. Chadwick, R. G., Alatsaris, M., & Ranka, M. (2007). Eye care habits of dentists registered in the United Kingdom. *British Dental Journal*, *203*(4), E7-E7.
45. Azizi, M. H. (2010). Occupational noise–induced hearing loss.
46. Szymanska, J. (2000). Work-related noise hazards in the dental surgery. *Annals of agricultural and environmental medicine*, *7*(2).
47. Samat, R. A., Shafei, M. N., Yaacob, N. A., & Yusoff, A. (2011). Prevalence and associated factors of back pain among dental personnel in North-Eastern State of Malaysia. *International Journal of Collaborative Research on Internal Medicine and Public Health*, *3*(7), 576-86.
48. Younai, F. S., Murphy, D. C., & Kotelchuck, D. (2001). Occupational exposures to blood in a dental teaching environment: results of a ten-year surveillance study. *Journal of dental education*, *65*(5), 436-448.